

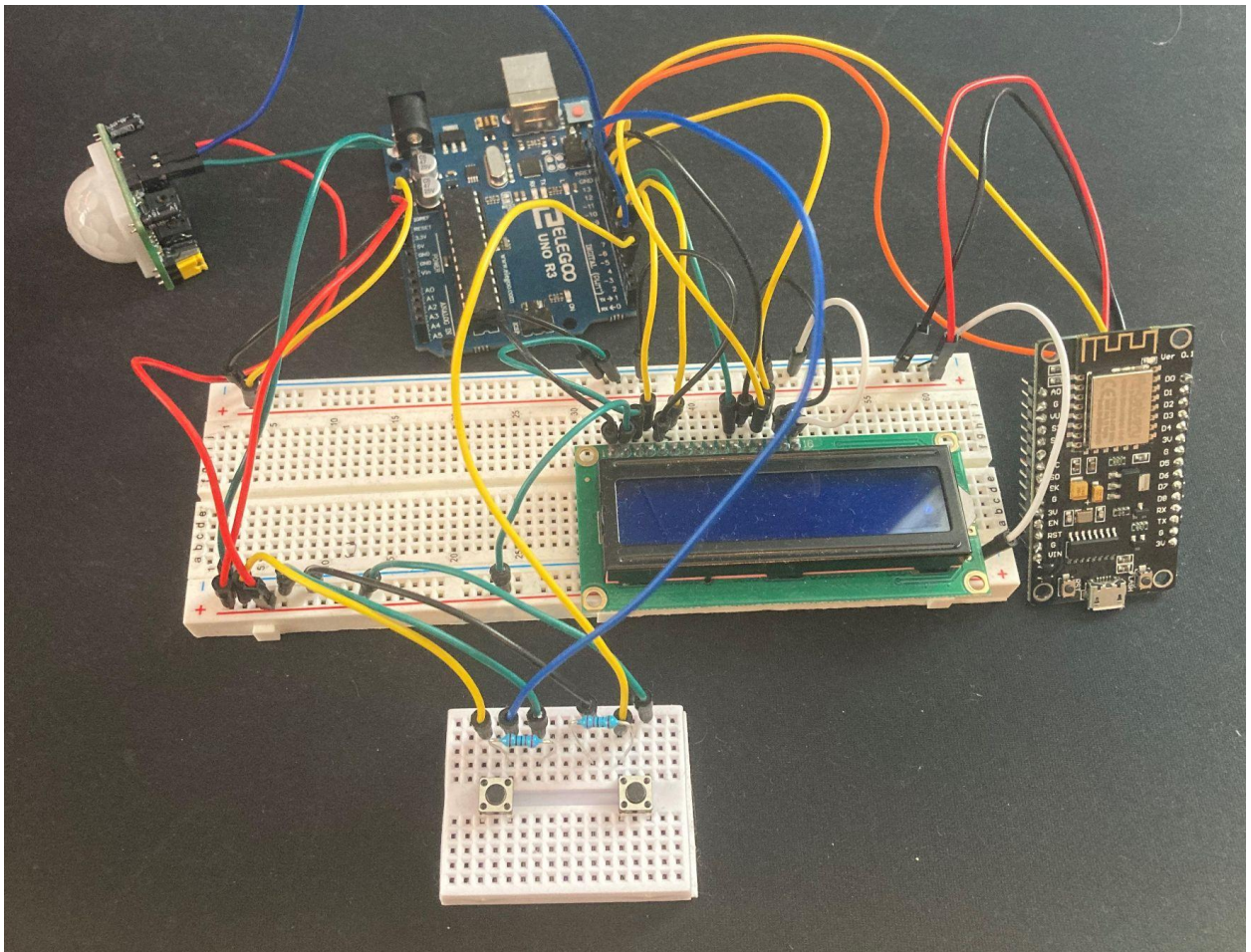
SE 12 - Internet of Things

Spring Semester 2021

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Self-Reflection Essay



Since I started working as a software engineer, I was interested in working with hardware and maybe develop my own IoT devices. Conveniently I was also able to connect this with ID 13 and do exactly that. After some thought and iterations, I ended up with this project idea: A small Arduino Uno IoT device that has two buttons, an LCD display, and a motion sensor. It is able to turn my smart home lamps in my living room on and off with the click of a button and also triggers them at night with the motion sensor to mitigate the need to turn them on and off by hand. The LCD display was mainly included for some visual support, to know the state of the lamp and which button does what. My goal was to include the requirements for both modules, so it was obviously needed to have some sort of internet connectivity to address the smart home lamps. That is why also included an ESP8266-12E, and of course, also wanted to learn more about that as well.

After finishing this project I can say that I had success in most of my goals. The project is working as expected. Most of the new things I learned are hardware-related, the code was fairly easy to write since I didn't have to learn anything new and I was able to apply my prior knowledge. The first thing I had some struggle with was the first wifi module I used (ESP8266-01), which is the most basic version of an ESP module with only a few pins and limited functionality and I only switched to my current module after multiple hours of work that didn't have any usable results. Without any lifehacks, that module can't have any input or output pins since they all have different primary functionality. So the best I was able to get to work, was to have two separate modules that either turn the lamp on or off respectively in the initialization, that meant that my Arduino had to power up each module every time the corresponding button was pressed and also power it down again in the end. This results in massive latency of up to 10 seconds between the button press and the lamp changing states. The second thing that could be seen as a small fail was the motion sensor. Originally I intended to use it at close quarters in my living room close to the door, but because of the anatomy of that sensor, I had to have a distance of at least 3 meters, because the sensor wouldn't actuate below that threshold. For those reasons, my motion sensor functionality is not as reliable as I was hoping it to be and I never developed it to a point, where it would trigger my lamp, since it would come in the way of the device working efficiently. The last problem I faced, was the security of my HTTP requests to trigger my webhooks to change the states of my lamp. I couldn't get an HTTPS request to work, which means that my data is transferred in cleartext over the internet. This potentially is a way for intruders to steal that endpoint and trigger my hooks without me knowing. Since I wanted to focus on different aspects of my project first, I skipped on this for now, but plan on fixing this issue down the road.

As I already stated, my biggest learning here was on the hardware side. I learned a lot about wiring, resistors, circuit diagrams, and general hardware relations. I also had to solder a bit for the ESP8266-12E module, since the pins were packaged separately. I thought that especially the circuit diagrams were very intimidating in the beginning but quickly got easier and I was able to use them efficiently for documentation and research.

I didn't really use any specific resource. I looked into multiple small Arduino projects that worked on similar ideas and worked my way through all the resources that were required. I had a friend that works a lot with microcontrollers professionally explaining to me how circuit diagrams work and also gave me some input on ESP modules after I wasn't successful with my first ESP module. What I was very surprised about was how many people publish their

Arduino projects on the <https://create.arduino.cc> website. It is a great resource to see what others have done so far.

I would confidently say that I covered all three aspects of working with IoT devices as mentioned in the module description to acquire a level 1. I think that my applied and acquired knowledge, especially in Communications Protocols, is not enough for a higher level.

I was successful in picking the right hardware and putting everything together. I developed a small application for the Arduino and the ESP module and worked with [I2C](#) to control my smart lamps with HTTP endpoints. Since I was planning on using the device plugged in without any power limitations, It was enough to use my wireless network at home and the WWW as a communication provider to communicate between my devices.